IOP SCIENCE
GRADES 8 TO 11

PROGRAM RATIONALE AND PHILOSOPHY

The Integrated Occupational Program (IOP) is a distinctive program for students who learn best through hands-on experiential learning activities and when the development of knowledge, skills and attitudes is relevant to their personal experiences. Meaningful connections between learning and the community result in successful transition from the school setting to the workplace and preparation for responsible citizenship.

IOP Science focuses on developing and applying essential science knowledge, skills and attitudes needed for everyday living at home, in the workplace and in the community. Science competencies are developed through investigating everyday and science-related problems, questions and issues that relate to students' current and future experiences. Applications to real-world activities/problems and community partnerships help students understand and appreciate the role of science in our society.

[redacted] for students in the Integrated [redacted]nal Program (IOP):

- [redacted] at the student's level of understanding
- [redacted]eveloped within a scientific inquiry [redacted]work emphasizing problem-solving and [redacted]ion-making skills and processes
- enhances the understanding of science within the contexts of home, workplace and community.

IOP Science emphasizes thinking processes, metacognition, career/life skills, teamwork and communication skills. Information and Communication Technology (ICT) outcomes and the use of calculators, computers and other technologies are integrated into the program to help students investigate problems, questions and issues, and connect and transition to the world beyond school.

PROGRAM VISION

The IOP Science program is guided by the vision that all students have the opportunity to develop scientific literacy. The goal of scientific literacy is to develop the science-related knowledge, skills and attitudes that students need to solve problems and make decisions, and to help students become lifelong learners and maintain their sense of wonder about the world around them.

Diverse learning experiences within the science program provide IOP students with opportunities to explore, analyze and appreciate the interrelationships among science, technology, society and the environment, and develop understandings that will affect their lives at home, in the workplace and in the community.

IOP SCIENCE GRADES 8 TO 11

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Science for students in the Integrated Occupational Program (IOP):

- begins at the student's level of understanding
- is developed within a scientific inquiry framework emphasizing problem-solving and decision-making skills and processes
- enhances the understanding of science within the contexts of home, workplace and community.

IOP Science emphasizes thinking processes, metacognition, career/life skills, teamwork and communication skills. Information and Communication Technology (ICT) outcomes and the use of calculators, computers and other technologies are integrated into the program to help students investigate problems, questions and issues, and connect and transition to the world beyond school.

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The IOP Science program is guided by the vision that all students have the opportunity to develop scientific literacy. The goal of scientific literacy is to develop the science-related knowledge, skills and attitudes that students need to solve problems and make decisions, and to help students become lifelong learners and maintain their sense of wonder about the world around them.

Diverse learning experiences within the science program provide IOP students with opportunities to explore, analyze and appreciate the interrelationships among science, technology, society and the environment, and develop understandings that will affect their lives at home, in the workplace and in the community.

SCIENCE FOUNDATIONS

IOP Science promotes the development of four foundations of science.

Foundation 1: Science, Technology and Society (STS)
Students will explore their home, workplace and community environments, gather knowledge, develop ideas, and use technology and other tools to make decisions about their personal lives, and will recognize the influence of science on decision making by individuals, communities and society.

Foundation 2: Knowledge
Students will investigate theories, models, concepts, processes and principles in life, physical, earth and space science as they relate to everyday living.

Foundation 3: Skills
Students will develop communication and teamwork, initiating and planning, performing and recording, and analyzing and interpreting skills to answer questions, solve problems and make decisions in their everyday lives.

Foundation 4: Attitudes
Students will be encouraged to develop science-related and lifelong attitudes and apply appropriate learning to personal behaviours at home, in the workplace and in the community. IOP Science emphasizes the development of positive attitudes and behaviours related to collaboration, mutual respect, safety and stewardship.

GOALS OF IOP SCIENCE

The principal goal of IOP Science is to assist students to become contributing members of society by building on the following science competencies:

- develop communication and teamwork skills to work collaboratively in a group
- develop attitudes that will enable them to use their knowledge and skills in a responsible manner
- develop skills, strategies and attitudes to be independent and lifelong learners
- select and apply appropriate science skills, tools and strategies to understand and interpret their world
- explore interests and ideas, using appropriate problem-solving and decision-making strategies
- apply science understandings to life/work situations.

COMPONENTS OF IOP SCIENCE

In order for students to solve problems and make decisions about science in relation to their everyday experiences, the components of science need to be organized into appropriate contexts. These contexts are the Units of Study.

The **Units of Study** provide the contexts within which skills, attitudes, knowledge and science, technology and society (STS) outcomes are developed as suitable for students' interests, abilities and everyday living at home, in the workplace and in the community.

Each unit of study has guiding questions and specific outcomes. Key concepts are in bold in the specific outcomes.

Skills
Skill outcomes in IOP Science assist students to further extend and apply their abilities to:
- *Communicate and Develop Teamwork*
- *Initiate and Plan*
- *Perform and Record*
- *Analyze and Interpret.*

Attitudes
For the benefit of themselves, society and the environment, students in IOP will be encouraged to develop and apply positive attitudes about:
- *Collaboration*
- *Mutual Respect*
- *Safety*
- *Stewardship*
- *Scientific Inquiry*
- *Interest in Science.*

Knowledge

Knowledge outcomes are to be addressed as appropriate to the abilities and needs of the IOP learner, focus on the student's local community and enhance students' understanding of:

- *Life Science*
- *Physical Science*
- *Earth and Space Science.*

Science, Technology and Society (STS)

Understandings about the relationships among the following are developed in IOP Science:

- *Nature of Science*
- *Science and Technology*
- *Social and Environmental Contexts of Science and Technology.*

Examples of everyday applications are provided in italics for guidance when relating school with beyond-school experiences. The examples do not form part of the required program.

CROSS-CURRICULAR, COMMUNITY AND WORKPLACE CONNECTIONS

IOP Science has similarities with, and linkages to, other secondary science programs. However, the IOP Science program of studies and resources are distinctive in that they promote cross-curricular, community and workplace connections.

Cross-curricular Connections

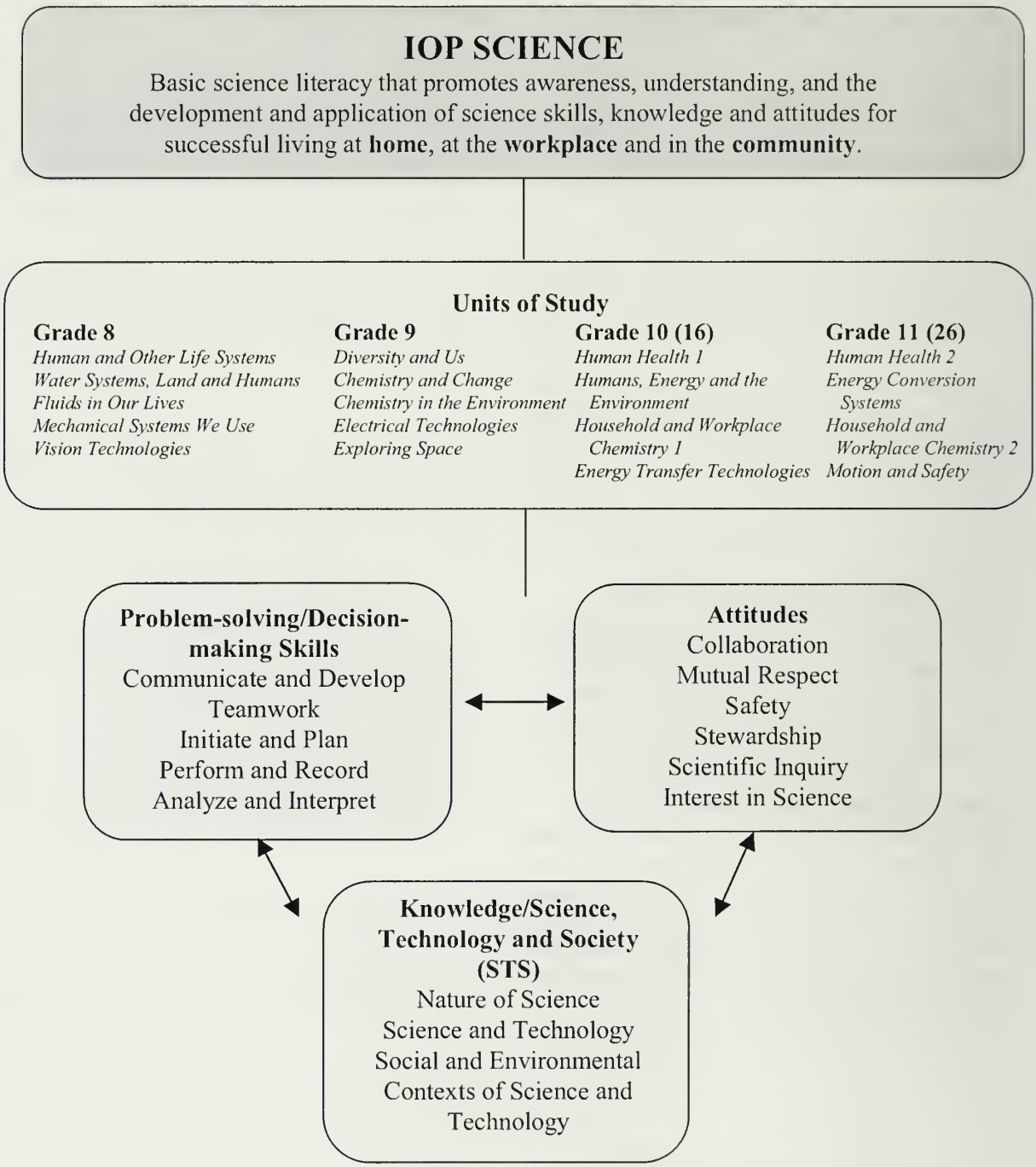
IOP Science promotes the integration of subjects to emphasize their interrelationships and connections to other school subjects. Teachers may wish to teach science in thematic units, or integrate science with units/projects in English language arts, mathematics, social studies and career development.

Community and Workplace Connections

IOP Science provides students with practical and applied opportunities to develop basic science competencies. Community partnerships connect the school with environments beyond school, including the workplace.

GRAPHIC OF IOP SCIENCE

The following graphic illustrates the IOP Science program.



GRADE 8

SCIENCE OUTCOMES: Students will develop and apply science skills, attitudes and knowledge as they relate to the units of study, to investigate everyday and science-related problems, questions and issues, perform experiments, and apply scientific process skills in home, workplace and community environments. Students will use science skills, attitudes and knowledge to develop an awareness of science-related and other careers.

SKILLS OUTCOMES: Students will apply science skills to a variety of everyday and science-related questions, problems and issues.

COMMUNICATE AND DEVELOP TEAMWORK

Students will use appropriate vocabulary to communicate scientifically, and appropriate communication and team building skills to work successfully in a group at school, at home, in the workplace and in the community.

Students will:

- communicate questions, ideas, intentions, plans and results, using a variety of such strategies as:
  - oral/written communication
  - lists, notes in point form, sentences
  - data tables, graphs, drawings
  - computer and/or other presentations
- communicate a position on an issue or problem based on personal/group findings, *e.g., safe storage of cleaning products at home, maintaining water levels in regional lakes or dugouts*
- act on the ideas of others, *e.g., examine storage of cleaning products at home and suggest changes as appropriate*
- investigate and apply appropriate strategies/skills to troubleshoot everyday problems.

INITIATE AND PLAN

Students will initiate the process of, and develop plans for, resolving problems, investigating issues and/or completing experiments, using technology as appropriate. Students will apply science-related initiating and planning skills to everyday situations at home, in the workplace and in the community.

Students will:

- identify everyday problems, questions and issues, *e.g., decisions about cafeteria service and healthy eating habits*
- identify science-related problems, questions and issues, *e.g., water/air quality in their local area*
- plan an investigation of everyday problems, questions and issues
- formulate and ask questions to clarify
- state a prediction, *e.g., The air quality in a rural community is better than the air quality in an urban community.*
- identify appropriate methods and tools for collecting data and information, *e.g., survey students about types of bicycles, helmet safety*
- plan and conduct a search, using a wide variety of electronic and other sources, *e.g., mammals living on other continents*
- identify the variables to be examined in the investigation or experiment, *e.g., the effects of rainfall in various water bodies in and around a community.*

PERFORM AND RECORD

Students will investigate everyday and science-related problems, questions and issues, perform experiments and record information, using technology as appropriate. Students will apply science-related performing and recording skills to everyday situations at home, in the workplace and in the community.

Students will:

- perform experiments and/or conduct investigations
- use reading, listening, recalling and other communication skills to locate information relevant to a problem or issue, *e.g., transportation routes to school, part time job or shopping areas*
- select information from various print and electronic sources
- use tools, technology and apparatus safely for collecting and organizing data
- identify data and information that are relevant to a given problem or issue
- compile and display data/information by hand and/or computer in a variety of formats, such as:
  - diagrams, flow charts, tables
  - bar or line graphs
- use and/or construct a classification key, *e.g., types of trees in Alberta*
- estimate and determine measurements
- design, construct and test prototypes as appropriate, *e.g., vehicles using elastics or batteries*
- create a simulation or a model, using technology, that permits the making of inferences, *e.g., create a mechanical system that will carry a load without using human power, develop a lens/instrument to improve vision*
- carry out procedures for controlling major variables
- create simple line drawings of observations or results, *e.g., compare the human body to simple machines or illustrate refraction of light in diagram form*
- perform a self- or group-designed investigation of an everyday problem, question or issue, *e.g., survey classmates or friends about everyday topics such as their favourite sport or musical groups.*

ANALYZE AND INTERPRET

Students will analyze and interpret results of everyday and science-related investigations/ experiments, and assess personal and group performance, using technology as appropriate. Students will apply science-related analyzing and interpreting skills to everyday home, workplace and community situations.

Students will:

- identify and discuss patterns in information and data
- identify discrepancies in data
- identify strengths and weaknesses of methods used to collect and display data
- test and evaluate the design of a constructed device or system
- state a reasonable response or conclusion to the problem/question/issue
- analyze and assess personal performance on a variety of individual and group investigations/experiments.

ATTITUDE OUTCOMES: Students will continue to be encouraged to develop and display collaboration, mutual respect, safety, stewardship, scientific inquiry and interest in science. Students will apply appropriate scientific attitudes to home, workplace and community situations.

COLLABORATION	*Students will be encouraged to:* • work collaboratively in carrying out investigations and in generating ideas.
MUTUAL RESPECT	*Students will be encouraged to:* • listen to and accept the viewpoints of others.
SAFETY	*Students will be encouraged to:* • accept the need for rules and regulations • show concern for safety in planning, carrying out and reviewing activities.
STEWARDSHIP	*Students will be encouraged to:* • demonstrate sensitivity in pursuing a balance between the needs of humans and the requirements for a sustainable environment.
SCIENTIFIC INQUIRY	*Students will be encouraged to:* • use scientific methods to carefully gather evidence in investigating problems and issues.
INTEREST IN SCIENCE	*Students will be encouraged to:* • show interest in science-related questions and issues.

KNOWLEDGE/SCIENCE, TECHNOLOGY AND SOCIETY (STS) OUTCOMES

UNITS OF STUDY: Units of study in IOP Science provide opportunities for students to construct knowledge and understanding in science, and apply these understandings to interpret, integrate and extend their knowledge at home, in the workplace and in the community. Outcomes are addressed in initial treatments only, and developed in relation to what students will need to know for everyday situations.

HUMAN AND OTHER LIFE SYSTEMS
(Cells and Systems)[1]

Guiding Questions
What are the systems of the human body, how do they work together and how can we keep them healthy?
How are the human body systems similar to and different from other organisms?

Students will:

- define **organisms** and give examples
- distinguish among **cells**, **tissues**, **organs** and **systems**
- recognize that organisms are made up of **systems**
- illustrate the relationship between **structure** and **function**
- use a variety of strategies, such as cause and effect, to explain **responses to stimuli** for a variety of organisms, *e.g., migration, hibernation, fight or flight response*
- list and describe the structure of systems of the human body, and identify their functions, i.e., circulatory, digestive, respiratory, reproductive
- investigate and evaluate medical, health and **environmental factors** affecting cells, systems and general health
- discuss how to maintain health, *e.g., physical condition in relation to the health of the circulatory system and heart.*

WATER SYSTEMS, LAND AND HUMANS
(Fresh and Saltwater Systems)

Guiding Questions
How do fresh and saltwater systems affect us, other organisms and our land?
What factors affect water and land in our community?

Students will:

- examine a familiar **human-made** and/or **natural water supply**
- distinguish an **aquatic ecosystem** from other ecosystems, *e.g., terrestrial*
- test and compare **water quality** of various samples from the community/area, *e.g., pH levels, sedimentation*
- examine and identify **water-borne materials** and organisms
- investigate adaptations of organisms to aquatic ecosystems, *e.g., streamlined shape, gills*
- demonstrate **erosion** and **deposition** of/in water systems
- illustrate the **characteristics of a stream**
- investigate erosion, deposition, movement of/in **ocean basins**
- relate **climate** and **weather** to **glaciers** and **ice caps**
- examine **human impact** on water supply, quality and distribution, *e.g., recreational vehicles and activities.*

1. Brackets represent title of related units of study in Science 8.

FLUIDS IN OUR LIVES
(Mix and Flow of Matter)

Guiding Questions
What are common examples of fluids?
What are properties of fluids?
How do we use liquids and the properties of liquids in our daily lives, e.g., concentrations of laundry soap, detergent and vehicle lubricants?

Students will:

- recognize **Workplace Hazardous Materials Information Systems (WHMIS)** and **Hazardous Household Product Symbols (HHPS)**
- apply **WHMIS** and **HHPS standards** in the school, home, workplace and community
- list everyday examples of types of **fluids**, *e.g., air, water, oil, carbon dioxide*
- identify **solute** and **solvent** in familiar liquids
- design and carry out investigations to examine **properties of fluids**, such as **concentration**, **solubility**, **viscosity**, **buoyancy**, **saturation point**
- design and carry out investigations to examine factors that affect the properties of fluids, such as temperature and pressure change
- calculate **flow rates** of familiar liquids using the formula flow rate = volume/time
- relate properties of fluids to liquids used in the home, workplace and community, *e.g., windshield washer fluid.*

MECHANICAL SYSTEMS WE USE
(Mechanical Systems)

Guiding Questions
What mechanical systems do we use every day?
How do mechanical systems impact our daily lives?
How do mechanical systems relate to the human body?

Students will:

- design and construct structures, individually and/or in groups, that do a variety of tasks, *e.g., vehicles that carry a load*
- illustrate the relationship between **design** and **function**, *e.g., elevators, bridges*
- examine and classify a variety of everyday **simple machines** and relate these to the human body
- identify **load**, **force**, **fulcrum**
- identify **systems** and **subsystems** of simple machines
- illustrate **speed** and **force** advantages of everyday simple machines and parts of the human body, *e.g., lifting a load using a pulley and the human arm*
- identify the use of simple machines, systems and subsystems at home, at the workplace and in the community.

VISION TECHNOLOGIES
(Light and Optical Systems)

Guiding Questions
What are vision technologies?
How do vision technologies influence our everyday lives?

Students will:

- examine various **sources of light**, *e.g., the Sun, stars, fluorescent lamps*
- predict and investigate the effects of light and lenses on **images**
- investigate microscopes, telescopes and other **optical devices**
- examine how light is **reflected**, **absorbed**, **refracted** and **transmitted**
- predict and investigate the effects of various materials on light
- compare the human eye to cameras, and compare human eyes to eyes of other organisms
- investigate the contribution of optical devices and related technologies to scientific development, *e.g., equipment used in micro-surgery*
- investigate how to keep eyes healthy.

GRADE 9

SCIENCE OUTCOMES: Students will develop and apply science skills, attitudes and knowledge as they relate to the units of study, to investigate everyday and science-related problems, questions and issues, perform experiments, and apply scientific process skills in home, workplace and community environments. Students will use science skills, attitudes and knowledge to develop an awareness of science-related and other careers.

SKILLS OUTCOMES: Students will apply science skills to a variety of everyday and science-related questions, problems and issues.

COMMUNICATE AND DEVELOP TEAMWORK

Students will use appropriate vocabulary to communicate scientifically, and appropriate communication and team building skills to work successfully in a group at school, at home, in the workplace and in the community.

Students will:

- work cooperatively with team members to develop and carry out a plan. *E.g.,*
  - *listen to the input of others*
  - *restate the plan objectives, goals*
  - *remain on task*
  - *encourage others to remain on task*
- recommend appropriate methods for summarizing and interpreting findings, *e.g., prepare a graph of types of vehicles used by classmates' families*
- support a personal/group position, using appropriate strategies/tools/methods, *e.g., electricity use in homes and alternative energy sources, environmental issues in the school yard*
- identify strategies/behaviours that enhance group activities
- evaluate their own performance in group activities
- investigate and apply a variety of appropriate strategies/skills to troubleshoot problems.

INITIATE AND PLAN

Students will initiate the process of, and develop plans for, resolving problems, investigating issues and/or completing experiments, using technology as appropriate. Students will apply science-related initiating and planning skills to everyday situations at home, in the workplace and in the community.

Students will:

- identify everyday and science-related problems, questions and issues, *e.g., Why are salt and sand used on winter roads? How much electricity is used over several months at home or the workplace? What are the most effective grades of oil to use in vehicles in Alberta?*
- list questions to investigate arising from everyday and science-related problems, questions and issues
- rephrase questions in testable forms
- state a prediction or hypothesis
- develop an action plan for an experiment or investigation
- select appropriate methods and tools for collecting data and information, *e.g., survey/interview members of the community*
- develop and clearly articulate a plan of action to use technology and other tools or strategies to investigate problems, questions and issues
- identify all the variables related to an investigation or experiment
- propose alternative solutions to a problem, question or issue
- evaluate choices and progress in problem solving, and redefine the plan of action as appropriate.

PERFORM AND RECORD

Students will investigate everyday and science-related problems, questions and issues, perform experiments and record information, using technology as appropriate. Students will apply science-related performing and recording skills to everyday situations at home, in the workplace and in the community.

Students will:

- carry out investigations of everyday and science-related problems, questions and issues, *e.g., care and breeding of domestic animals*
- perform experiments using tools, technology and apparatus safely, effectively and accurately
- use appropriate research skills to locate information relevant to a given problem or issue, *e.g., technology, experimentation*
- use instruments effectively and accurately for collecting data, *e.g., microscopes, compass, global positioning system (GPS), balance scales*
- demonstrate knowledge of the Workplace Hazardous Materials Information System (WHMIS) standards and symbols, and applications at home, in the workplace and in the community
- record, organize and display data/information by hand and/or computer in a variety of formats, such as:
  - diagrams, flow charts, tables
  - bar, line or other graphs
  - classification keys
- create and label diagrams/drawings, using technology as appropriate, *e.g., draw mechanical systems, microscopes, atoms and molecules.*

ANALYZE AND INTERPRET

Students will analyze and interpret results of everyday and science-related investigations/ experiments, and assess personal and group performance, using technology as appropriate. Students will apply science-related analyzing and interpreting skills to everyday home, workplace and community situations.

Students will:

- identify strengths and weaknesses of different methods of collecting and displaying data
- identify patterns and trends in information and data gathered
- identify and suggest explanations for discrepancies in data
- evaluate designs and prototypes in terms of one or more of the following: function, reliability, safety, efficiency, use of materials, impact on the environment, *e.g., compare various types of can openers*
- demonstrate/communicate how evidence gathered supports or refutes an initial problem/issue/idea/hypothesis
- apply given criteria for evaluating evidence and sources of information
- identify new questions and problems that arise from what has been learned
- state conclusions and inferences based on results/outcomes
- identify potential applications of findings
- use a variety of tools and strategies to assess personal performance in a group situation, *e.g., at home, with a peer group.*

ATTITUDE OUTCOMES: Students will continue to be encouraged to develop and display collaboration, mutual respect, safety, stewardship, scientific inquiry and interest in science. Students will apply appropriate scientific attitudes to home, workplace and community situations.

COLLABORATION	*Students will be encouraged to:* • work collaboratively in carrying out investigations and in generating and evaluating ideas.
MUTUAL RESPECT	*Students will be encouraged to:* • listen to and accept the viewpoints of others.
SAFETY	*Students will be encouraged to:* • accept the need for rules and regulations • show concern for safety in planning, carrying out and reviewing activities.
STEWARDSHIP	*Students will be encouraged to:* • demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and the requirements for a sustainable environment.
SCIENTIFIC INQUIRY	*Students will be encouraged to:* • seek evidence when evaluating alternative approaches to investigations, problems and issues • use scientific methods to carefully gather evidence in investigating problems and issues.
INTEREST IN SCIENCE	*Students will be encouraged to:* • pursue personal interests and career possibilities within science-related fields.

KNOWLEDGE/SCIENCE, TECHNOLOGY AND SOCIETY (STS) OUTCOMES

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DIVERSITY AND US
(Biological Diversity) [1]

Guiding Questions
How are humans similar to and different from other organisms?
What factors affect our development and growth?

Students will:

- define **biological diversity**
- define **species**, **community**, **population** and **habitat**, give familiar examples, and relate to diversity within/among species
- relate **sexual/asexual reproduction** and **inherited traits** to diversity, using familiar organisms, *e.g., flowers, dogs, cattle, crops*
- relate the influences of heredity and environment on development
- investigate the role of chromosomes, genes and DNA in heredity (introductory treatment only)
- relate **natural** and **artificial selection** of genetic characteristics to real life situations, *e.g., breeding for specific traits, camouflage.*

CHEMISTRY AND CHANGE
(Matter and Chemical Change)

Guiding Questions
How do chemicals change?
What factors cause chemical change?
How do chemical changes affect our lives?

Students will:

- relate **WHMIS** and **safety** to classroom, home and workplace settings
- identify the **properties of matter** that are commonly applied in everyday situations
- examine, through observation and/or experimentation, factors affecting change in matter and **reaction rates**, *e.g., melting snow, cooking food*
- describe materials in terms of their **physical** and **chemical** properties, *e.g., flammable/non-flammable workplace liquids, fire-retardant clothing*
- identify **reactants** and **products** in simple chemical reactions
- illustrate **conservation of mass** and relate it to home, workplace and environmental situations, *e.g., What happens to the ingredients of a cake during the baking process? How do substances such as liquid string, shaving cream, whipped cream and insulation in a can work?*
- apply simplified chemical nomenclature in describing **elements**, **compounds** and **chemical reactions** (introductory treatment only).

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1. Brackets represent title of related units of study in Science 9.

CHEMISTRY IN THE ENVIRONMENT
(Environmental Chemistry)

Guiding Questions
What chemicals are important to our lives?
What chemicals are beneficial or harmful to humans and other organisms?

Students will:

- identify **chemicals** and **nutrients** essential to life and how to acquire them
- investigate **acids** and **bases** and how we use them
- identify patterns in chemical change and use patterns to predict changes, *e.g., endothermic and exothermic reactions*
- collect local data/information about environmental and related issues, and compare with global data
- examine the **ingestion** and **absorption** of materials by organisms
- investigate local **air and water quality**, *e.g., pH, levels of toxins/pollutants*
- identify **organic** and **inorganic** materials in air and water
- examine the effects of using **toxins**, *e.g., concentration, dispersal hazards and risks*
- examine the environmental impact of humans on air and water, i.e., **biodegradable/nonbiodegradable** materials on local waste collection and storage.

ELECTRICAL TECHNOLOGIES
(Electrical Principles and Technologies)

Guiding Questions
How do we use electricity at home, in the workplace and in the community?
How do we calculate energy use?
How can we use technology and other methods to increase electrical efficiency?

Students will:

- identify everyday **forms of energy** and give examples of their use, *e.g., mechanical, chemical, thermal, electrical*
- examine the influence of electrical energy on life at home, in the workplace and in the community
- examine and list common forms of **energy conversion**, *e.g., chemical to sound in radio batteries, chemical to mechanical when riding a bicycle*
- investigate the **generation of electrical energy** using water, coal, wind and others
- examine and illustrate the relationship among electric **charge**, **current** and **circuits**
- measure and calculate units of electrical energy (introductory treatment), *e.g., volts, amps, watts*
- investigate energy **storage** and **transmission**
- identify **renewable** and **nonrenewable** energy sources.

EXPLORING SPACE
(Space Exploration)

Guiding Questions
What do we use to explore space?
How does/may space exploration affect us?
How do we affect space?

Students will:

- investigate our **solar system**
- identify patterns and make predictions about **motion in space**, *e.g., phases of the moon, effects of change in gravitational pull, movement of man-made satellites and star systems, tides*
- examine composition and characteristics of bodies in space, *e.g., satellites and orbits, distribution of matter through space*
- investigate technologies that contribute to **space travel** and **space exploration**, *e.g., radio transmission, global positioning systems (GPS), space stations and telescopes*, and how they affect our everyday lives
- examine risks of, and human influences on, space and space travel
- examine influences of space exploration on humans, i.e., **communication technologies**.

GRADE 10 (16)

SCIENCE OUTCOMES: Students will develop and apply science skills, attitudes and knowledge as they relate to the units of study, to investigate everyday and science-related problems, questions and issues, perform experiments, and apply scientific process skills in home, workplace and community environments. Students will use science skills, attitudes and knowledge to develop an awareness of science-related and other careers.

SKILLS OUTCOMES: Students will apply science skills to a variety of everyday and science-related questions, problems and issues.

COMMUNICATE AND DEVELOP TEAMWORK

Students will use appropriate vocabulary to communicate scientifically, and appropriate communication and team building skills to work successfully in a group at school, at home, in the workplace and in the community.

Students will:

- identify multiple perspectives that influence a science-related decision or issue
- recognize and support alternative decisions as group members and as individuals
- recommend appropriate ways to summarize and interpret findings
- develop, present and defend a position or course of action based on findings, *e.g., create a poster, brochure, dramatization or computer presentation to demonstrate healthy lifestyle choices, or safe disposal of hazardous wastes*
- use a variety of strategies to troubleshoot problems as they arise
- use a variety of strategies and tools to assess individual and group processes used in planning, problem solving, decision making and task completion, *e.g., peer assessment, discussion, self-assessment*
- communicate problems, plans and results in a variety of ways, such as:
  - written/oral language
  - tables
  - graphs
  - drawings
  - demonstrations
  - computer/other presentations.

INITIATE AND PLAN

Students will initiate the process of, and develop plans for, resolving problems, investigating issues and/or completing experiments, using technology as appropriate. Students will apply science-related initiating and planning skills to everyday situations at home, in the workplace and in the community.

Students will:

- identify everyday and science-related problems, questions and issues, and develop an action plan, *e.g., develop a plan for the safe storage of chemicals at the workplace*
- ask questions
- identify consequences of various strategies
- identify strategies, tools and other resources for gathering and organizing information/data
- identify the variables related to an investigation/experiment
- select appropriate sampling procedures, *e.g., survey co-workers about workplace safety*
- identify/locate relevant background information using appropriate resource skills such as:
  - skimming or scanning to locate key words and phrases
  - listening
  - interviewing
  - viewing
  - recalling
- record relevant background information using appropriate strategies such as:
  - note-taking
  - recording on cassette tapes
  - making charts or tables
- propose alternative solutions to a scientific problem
- design an investigation/experiment.

PERFORM AND RECORD

Students will investigate everyday and science-related problems, questions and issues, perform experiments and record information, using technology as appropriate. Students will apply science-related performing and recording skills to everyday situations at home, in the workplace and in the community.

Students will:

- perform experiments and/or conduct investigations, including some that are self- or group-designed
- demonstrate knowledge of WHMIS standards and symbols by using proper techniques for handling and disposing of laboratory materials
- apply appropriate sampling procedures, *e.g., survey community members about tobacco use*
- use tools, technology and apparatus safely and effectively in collecting and organizing data
- record and organize data and information, using formats and data treatments as appropriate to facilitate interpretation of the data, selecting and integrating information from various print and electronic sources or from several parts of the same source
- create and label diagrams/drawings, using technology as appropriate, *e.g., label equipment at the workplace.*

ANALYZE AND INTERPRET

Students will analyze and interpret results of everyday and science-related investigations/ experiments, and assess personal and group performance, using technology as appropriate. Students will apply science-related analyzing and interpreting skills to everyday home, workplace and community situations.

Students will:

- assess various methods used to gather, organize and display data
- discuss the reasonableness of data, information and/or results
- evaluate designs and prototypes in terms of one or more of the following: function, reliability, safety, efficiency, use of materials, impact on the environment, *e.g., compare designs and efficiency of various energy transfer technologies*
- identify and correct problems in the way a prototype or constructed device functions
- use specific language that is scientifically and technologically appropriate to communicate results, *e.g., use appropriate vocabulary at the workplace*
- use data or information gathered to defend or support a prediction or hypothesis
- explain relationships among variables
- identify potential sources of error
- explain how evidence gathered supports or refutes an initial hypothesis
- state a reasonable response, inference and/or conclusion to a problem, question or issue
- use a variety of tools and strategies to assess self and group performance, *e.g., checklists at the workplace.*

ATTITUDE OUTCOMES: Students will continue to be encouraged to develop and display collaboration, mutual respect, safety, stewardship, scientific inquiry and interest in science. Students will apply appropriate scientific attitudes to home, workplace and community situations.

COLLABORATION

Students will be encouraged to:

- work collaboratively in carrying out investigations and in generating and evaluating ideas.

MUTUAL RESPECT

Students will be encouraged to:

- appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds.

SAFETY

Students will be encouraged to:

- be aware of the direct and indirect consequences of person/group actions.

STEWARDSHIP	*Students will be encouraged to:* • value the personal, social and environmental consequences of a proposed action • develop a sense of personal and shared responsibility for maintaining a sustainable environment • project the personal, social and environmental consequences of a proposed action • display a desire to take action for maintaining a sustainable environment.
SCIENTIFIC INQUIRY	*Students will be encouraged to:* • apply a variety of strategies to investigate questions, problems and issues • use scientific methods to carefully gather evidence in investigating problems and issues • value the scientific process • use factual information and rational explanations when analyzing and evaluating.
INTEREST IN SCIENCE	*Students will be encouraged to:* • show interest in science-related questions and issues • pursue personal interests and career possibilities within science-related fields.

KNOWLEDGE/SCIENCE, TECHNOLOGY AND SOCIETY (STS)

UNITS OF STUDY: Units of study in IOP Science provide opportunities for students to construct knowledge and understanding in science, and apply these understandings to interpret, integrate and extend their knowledge at home, in the workplace and in the community. Outcomes are addressed in initial treatments only, and developed in relation to what students will need to know for everyday situations.

HUMAN HEALTH 1
(Investigating Matter and Energy in Living Systems) [1]

Guiding Questions
What lifestyle choices will increase the health of our organs and organ systems?
What home, workplace or community factors have the potential to improve/harm our health?

Students will:

- investigate and explain **healthy lifestyles**, **human nutritional needs** and how to meet them
- examine **functions** and relationships among digestive, respiratory and circulatory systems and how to maintain health
- examine **social** and other influences on human health, *e.g., media, peer pressure, diets and weight-loss programs*
- investigate health risks and disorders of the **digestive**, **respiratory** and **circulatory** systems (introductory treatment)
- describe the life functions of **cells** and major **organ systems**
- identify basic **cell structures** of plant and animal cells
- examine strategies used by living organisms to store or use energy, *e.g., fat cells, photosynthesis, respiration*
- investigate the **human reproductive system** and issues related to human sexuality (introductory treatment)
- describe the role of technology in monitoring human health, *e.g., stethoscope, electrocardiogram (ECG).*

HUMANS, ENERGY AND THE ENVIRONMENT
(Investigating Matter and Energy in the Environment)

Guiding Questions
What forms of energy do humans use?
In what ways do we affect energy in the environment?
What are alternative forms of energy?

Students will:

- investigate **food chains**, **webs** and **energy pyramids**
- describe the role of living organisms in recycling matter
- examine the influence of humans on the environment, including our use of
  - biodegradable/nonbiodegradable materials
  - modern agricultural technologies and practices, *e.g., feedlots, automated feeding, watering and milking systems, low or no tillage*
  - motor vehicles
  - recycling human-generated wastes
- examine factors affecting **population growth**
- examine a local **ecosystem** and identify human impact on it
- describe in general terms the characteristics of Alberta **biomes**
- investigate and identify **environmental laws** and recognize that they exist for a purpose.

1. Brackets represent title of related units of study in Science 14.

HOUSEHOLD AND WORKPLACE CHEMISTRY 1
(Investigating Properties of Matter)

Guiding Questions
What chemicals are used at home and in the workplace, and how are they used?
What safety standards exist for use, storage and transportation of chemicals?

Students will:

- communicate and demonstrate safe handling, storage and disposal of household and workplace chemicals using WHMIS and HHPS
- examine properties of **solutions** and the **solubility** of substances found in the household or workplace, *e.g., concentration, flow rates*
- apply concepts of solution, solubility and concentration to household and workplace tasks, *e.g., preparing food, removing stains from floors and clothing*
- prepare **solutions**, separate **mixtures** and apply findings to everyday situations
- illustrate **change of state**, *e.g., water to steam or ice*
- investigate common chemical changes, such as corrosion, rusting
- investigate, list and communicate properties of fluids, such as viscosity, flow rates, buoyancy, and how properties influence the use of fluids.

ENERGY TRANSFER TECHNOLOGIES
(Understanding Energy Transfer Technologies)

Guiding Questions
What energy transfer technologies are used in everyday life?
How can we use energy transfer technologies to meet our needs and conserve energy?

Students will:

- distinguish among **temperature**, **heat** and **thermal** energy
- examine **methods to reduce heat loss** in homes and buildings
- examine an application of the principle that heat is transferred from hot to cold objects
- examine cooling and heating systems based on **radiation**, **convection**, **conduction** and **thermal** energy, *e.g., conventional ovens, microwave ovens*
- examine methods of reducing thermal energy transfer, *e.g., insulation, materials used for firefighting equipment and clothing, construction of space craft*
- illustrate simple machines that reduce reliance on **nonrenewable energy** sources.

GRADE 11 (26)

SCIENCE OUTCOMES: Students will develop and apply science skills, attitudes and knowledge as they relate to the units of study, to investigate everyday and science-related problems, questions and issues, perform experiments, and apply scientific process skills in home, workplace and community environments. Students will use science skills, attitudes and knowledge to develop an awareness of science-related and other careers.

SKILLS OUTCOMES: Students will apply science skills to a variety of everyday and science-related questions, problems and issues.

COMMUNICATE AND DEVELOP TEAMWORK

Students will use appropriate vocabulary to communicate scientifically, and appropriate communication and team building skills to work successfully in a group at school, at home, in the workplace and in the community.

Students will:

- work appropriately as a member of a team when investigating science-related and/or everyday problems or issues
- communicate information and ideas and assess results using the skills and conventions of science
- develop and defend a personal position/action, *e.g., prepare a presentation about transportation safety*
- select and use appropriate methods/tools when communicating ideas, plans and results to others, *e.g., computer-generated reports, graphs, presentations*
- use appropriate strategies to troubleshoot problems, *e.g., prepare and communicate a plan to share workplace tools and other resources*

INITIATE AND PLAN

Students will initiate the process of, and develop plans for, resolving problems, investigating issues and/or completing experiments, using technology as appropriate. Students will apply science-related initiating and planning skills to everyday situations at home, in the workplace and in the community.

Students will:

- design an experiment/investigation and identify manipulated, responding, and controlled variables
- use appropriate methods and tools for collecting data and information
- create a plan for an inquiry that includes consideration of time management, *e.g., develop a vehicle maintenance plan that includes timelines*
- propose alternative solutions to a life/work problem, select one and develop a plan, *e.g., communicating safety at the workplace*
- develop an action plan that will assist when planning for life- or work-related problem solving, inquiry and decision making, *e.g., seatbelt use, workplace access for people in wheelchairs*
- evaluate the appropriateness of the technology used to investigate or solve a problem.

PERFORM AND RECORD

Students will investigate everyday and science-related problems, questions and issues, perform experiments and record information, using technology as appropriate. Students will apply science-related performing and recording skills to everyday situations at home, in the workplace and in the community.

Students will:

- design and carry out experiments and/or investigations, *e.g., gather information from Health Canada and other sources to become more informed about human health, examine the effects of heat and water on vehicle paint*
- use tools, technology and apparatus safely
- select and integrate information from various print and electronic sources or from several parts of the same source
- gather, record and organize data and information, using appropriate tools, formats and data treatments to facilitate interpretation of the data, *e.g., keep records at home of monthly expenditures, record information or invoices at the workplace*
- use charts, surveys, electronic and/or other research tools/methods to collect and display information on life- or work-related topics, *e.g., create a list of community support services for individual and family use, gather information about safety features of selected vehicles.*

ANALYZE AND INTERPRET

Students will analyze and interpret results of everyday and science-related investigations/ experiments, and assess their own personal and group performance, using technology as appropriate. Students will apply science-related analyzing and interpreting skills to everyday home, workplace and community situations.

Students will:

- identify and evaluate a variety of methods for collecting and displaying data
- develop criteria for evaluating a device/prototype
- evaluate their own personally designed and constructed device/ prototype
- identify and explain sources of error and uncertainty in measurement, and express results in a form that acknowledges the degree of uncertainty
- identify and apply a variety of criteria for evaluating evidence and sources of information, such as:
  - social factors
  - methods of collecting data
  - data and related research and relevance
  - presence of bias
- use a variety of methods/strategies to interpret data and information, such as diagrams, flow charts, tables, graphs
- examine the reasonableness of results/information
- synthesize information from multiple sources
- explain how evidence gathered supports or refutes an initial hypotheses or decision
- identify and evaluate everyday applications of findings.

ATTITUDE OUTCOMES: Students will continue to be encouraged to develop and display collaboration, mutual respect, safety, stewardship, scientific inquiry and interest in science. Students will apply appropriate scientific attitudes to home, workplace and community situations.

COLLABORATION

Students will be encouraged to:

- develop attitudes that support collaborative activity
- work collaboratively when planning, carrying out investigations and generating and evaluating ideas.

MUTUAL RESPECT

Students will be encouraged to:

- appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds.

SAFETY

Students will be encouraged to:

- appreciate the need for standardized safety rules and regulations in society
- demonstrate a concern for safety in science and technology contexts and show concern for safety
- accept the need for rules and regulations.

STEWARDSHIP

Students will be encouraged to:

- project the personal, social and environmental consequences of proposed action in life/work situations
- develop responsibility in the application of science and technology in relation to society and the natural environment
- appreciate the need to take action for maintaining a sustainable environment.

SCIENTIFIC INQUIRY

Students will be encouraged to:

- develop attitudes that support active inquiry, problem solving and decision making in life/work situations
- evaluate evidence and consider and appreciate alternative perspectives, ideas and explanations in life- or work-related situations.

INTEREST IN SCIENCE

Students will be encouraged to:

- show a continuing and informed curiosity and interest in science and science-related issues
- develop enthusiasm and continuing interest in the study of science
- consider further studies and careers in science- and technology-related fields.

KNOWLEDGE/SCIENCE, TECHNOLOGY AND SOCIETY (STS) OUTCOMES

UNITS OF STUDY: Units of study in IOP Science provide opportunities for students to construct knowledge and understanding in science, and apply these understandings to interpret, integrate and extend their knowledge at home, in the workplace and in the community. Outcomes are addressed in initial treatments only, and developed in relation to what students will need to know for everyday situations.

HUMAN HEALTH 2
(Disease Defense and Human Health) [1]

Guiding Questions
What factors affect human health?
What factors can be controlled and how?
How can we maintain good health?

Students will:

- discuss a variety of factors that impact human health, *e.g., geography, economy, nutrition, food supply*
- discuss the role of **environmental factors** on health, *e.g., toxins, pathogens*
- investigate **communicable** and **noncommunicable diseases**
- suggest and communicate human actions to reduce **contamination**
- examine factors that affect our **natural defense mechanisms**, *e.g., nutrition, healthy diet, rest*
- communicate the role of the human body's defence mechanisms in maintaining health
- investigate how simple **human inheritance** relates to health
- investigate the role of the individual and/or society in decision making regarding human health, *e.g., smoking, genetics, immunization*
- investigate and communicate information about community organizations that promote health and healthy living
- develop an action plan to promote a **healthy lifestyle.**

ENERGY CONVERSION SYSTEMS
(Understanding Common Energy Conversion Systems)

Guiding Questions
What energy conversion systems are present in our everyday lives?
How do they influence us at home, in the workplace and in the community?

Students will:

- investigate **chemical** and **energy changes**, *e.g., food as fuel for humans*
- examine **combustion** and the use of **fossil fuels**
- investigate generation and distribution of electricity, electric charge, currents, circuits
- investigate and describe evidence of **energy transformations** in the home, community and workplace, i.e., generation and distribution of electricity, home use of heating fluids
- identify electrical household and workplace **devices** as **converters** of energy
- explain **energy consumption** and relate it to everyday experience
- measure/identify **units of electrical energy**, *e.g., read gauges/meters and understand energy consumption at home and in the workplace*

1. Brackets represent title of related units of study in Science 24.

- examine the uses of energy and its effects on the **environment**
- examine **input energy**, **output energy** and **conservation of energy**
- explain, in general terms, the need for a balance between food intake and energy output for normal metabolic functions, exercise, and growth and repair of cells
- classify **sources of energy in food** as **carbohydrates**, **fats** and **proteins**, and examine the need to have a balance of these in the diet
- describe factors that affect **metabolism**, such as age, fitness level, time of day, general health.

HOUSEHOLD AND WORKPLACE CHEMISTRY 2
(Applications of Matter and Chemical Change)

Guiding Questions
How do chemicals and chemical changes influence our lives in the home, workplace and community?

Students will:
- identify commonly used materials/chemicals
- investigate **chemical change/reactions** in the home and the workplace
- identify harmful chemical changes and determine how to avoid them, *e.g., rusting of metals, mixing cleaning products*
- distinguish the properties of **metals** and **nonmetals**
- identify and apply appropriate **safety standards** at home, at the workplace and in the community, *e.g., WHMIS in the workplace.*

MOTION AND SAFETY
(Motion, Change and Transportation Safety)

Guiding Questions
What positive transportation factors are present in our community?
What transportation factors in our community could be improved?
How can we increase transportation safety?

Students will:
- identify **input force**, **output force** and **fulcrum** in simple household and workplace machines
- examine the relationships among **reaction time**, **speed** and **distance**
- explain/demonstrate how **simple machines**, at home or in the workplace, make work easier
- gather **transportation safety** information from a variety of sources, *e.g., safety systems designed to reduce impact of collisions*
- investigate, collect and communicate data and information on reaction time, speed, safe following distance and other transportation safety issues
- examine and discuss transportation **safety regulations**
- investigate basic vehicle maintenance
- investigate and communicate ways to increase transportation safety in your community, *e.g., traffic lights, stop signs, police presence.*